the maximum Dice coefficient, Table 1. In the next stage the performance of the non-rigid algorithm combined with LS segmentation of the GTV was investigated. Figure 1 shows typical results produced by the algorithm on pre- and post-RT CT: Left: Reference image with GTV contour (blue). Middle: target image with GTV contour (yellow). Right: The automatically generated contour (red) and the original GTV contour (yellow). The blue contour shows the reference image GTV expanded and used as the initial zero LS function. The Dice coefficient was 88.01% over the whole volume.

Optimisation Parameter	Rigid Registration Dice (%)			
	SSD	SSD of SIFT	MI	MI of SIFT
Ω	0	37.97	0	76.07
(T_x, T_y)	73.93	0	0	76.07

Table 1:

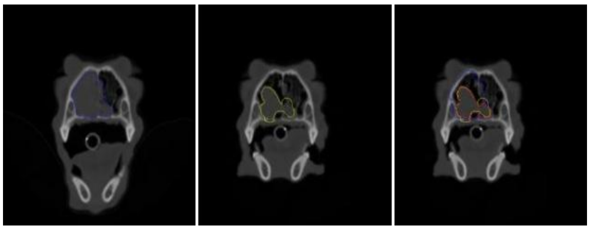

Figure 1:

Conclusions: The proposed framework demonstrates that it is possible to automatically segment the GTV on post-radiotherapy images with acceptable clinical accuracy (Dice = 88.01%). On this limited data set the approach shows promise as a tool for assisting clinicians assess response to RT and has the potential to be used for adaptive radiotherapy. Work is ongoing to assess the performance of the approach on a larger multi-modality human and canine data set.

EP-1542

Characterization of 3D geometric distortion of MRI scanners commissioned for RT planning

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Purpose/Objective: To develop a method for the assessment and characterization of 3D geometric distortion as part of routine quality assurance for MRI scanners commissioned for RT planning

Materials and Methods: Although MRI is particularly effective at differentiating between soft tissues, it is known to suffer from geometric distortion which represents an important consideration when implementing it into the RT planning process. In this study, the in-plane and through-plane geometric distortion on a 1.5T GE MRI-SIM unit are characterized and the 2D and 3D correction algorithms provided by the vendor are evaluated.

We used a phantom developed by GE Healthcare that covers a large field of view of 500mm, and consists of layers of foam embedded with a matrix of spherical markers. An in-house Java-based software module was developed to automatically assess the geometric distortion by calculating the center of each marker using the center of mass method, correcting of gross rotation errors and comparing the corrected positions with a CT gold standard data set. Spatial accuracy of typical pulse sequences used in RT planning was assessed (2D T1/T2 FSE, 3D CUBE, T1 SPGR) using the software. The accuracy of vendor specific geometric distortion correction (GDC) algorithms was quantified by measuring distortions before and after the application of the 2D and 3D correction algorithms.

In this work, distortions related to the superior/inferior gradient are referred to as through-plane distortions.

Results:

Figure 1-A shows the mean geometric distortions before and after the application of GDC algorithms. For all sequences, these algorithms were able to substantially reduce the distortions from 1.8, 4.6, 7.8 and 12.58mm to 0.5, 0.8, 2.5 and 4.5 mm for radial distances of 15, 20, 25 and 50cm respectively.

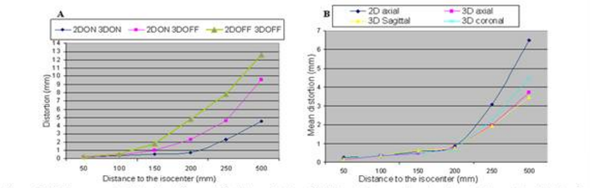

Figure 1. A) Mean geometric distortion before and after the application of the 2D and 3D correction algorithms. B) Geometric distortion for all acquisition planes.

Our results showed also that the impact of the acquisition plane produced a maximum distortion variation of 0.15, 0.2, 1.1 and 3mm for radial distances of 15, 20, 25 and 50cm respectively.

Finally, the 3D correction algorithm, when applied with the 2D correction algorithm, reduces the in-plane distortion for all acquisitions from a mean value of 0.8, 1.9, 4.1 and 6.8mm to 0.4, 0.6, 1.6 and 3.2mm within a radial distance of 15, 20, 25 and 50 cm respectively.

Conclusions: The presented methods represent a valuable tool for routine quality assurance of MR applications that require stringent spatial accuracy assessment such as radiotherapy. The results of this study showed that the correction algorithms provided by GE Healthcare reduced significantly both the in-plane and through-plane distortions. For a radial distance of 20cm, the application of GDC derives residual distortions less than 1mm which is within the accuracy required for most radiotherapy procedures. Our results demonstrated that the choice of the acquisition plane does not significantly impact the geometric distortion up to a radical distance of 20cm, and hence can be based upon optimum clinical parameters including shortest acquisition time.

EP-1543

Investigation of the accuracy of MV radiation isocentre calculations in the Elekta cone-beam CT software XVI

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Purpose/Objective: Most modern radiotherapy treatments are based on cone-beam CT images to ensure precise positioning of the patient relative to the linac. This requires alignment of the cone-beam CT system to the linac MV radiation isocentre. Therefore, it is important to precisely